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Commentary

Role of Stem Cells in Brain Stroke Treatment

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DESCRIPTION

The ageing process is related with a higher risk factor for stroke in both men and women, and it remains a significant health issue with no acknowledged therapy method for ischemic stroke other than thrombolysis with recombinant tissue plasminogen activator. Aged brains react to stroke differently than young brains, according to studies conducted on animals before the use of old animals. A major factor in the exacerbated neuroinflammation and poor recovery following stroke is age-related microglia activation in response to stroke.

The sex ratio is flipped in very elderly persons (more women than men), probably as a result of their longer life expectancies, sex-related differences, and age-related changes, according to sex variations in stroke incidence. Many neurological illnesses in ageing individuals are linked to decreased neurogenesis and decreased stem/progenitor cell proliferation. With the use of supporting pharmaceutical therapy, stem cell-based therapy is a promising approach for fostering neuroregeneration following brain injury, especially when the ageing process is involved.

Instead of replacing damaged tissue, stem cell therapy focuses on improving function in the early phases of stroke recovery. Additionally, stem cells can be a helpful tool for gene therapy in regenerative medicine because of their plasticity and affinity for injured tissue. In a "glio-neurovascular niche," cell damage following a stroke affects not only neurons but also other types of brain tissue and extracellular matrix.

In light of this, methods that target brain cells, such as growth factors or stem cell therapy, are promising aids in post-stroke regeneration. Neuroprotection, axonal sprouting and regeneration, angiogenesis, and control of neuroinflammation are a few of the mechanisms involved in neuroregeneration of cell therapy after stroke. However, the appropriate delivery method, dosages, or window of time following lesion are still being debated. The mechanism of action is individual to a certain grafted cell type.

Although Bone Marrow-Derived Mononuclear Cells (BM-MNCs) represent a promising treatment option for acute stroke, the majority of preclinical studies used young animals free of concomitant conditions.

To differentiate, survive, and repair the loss of neuronal cells, as well as on the quantity of BM-MSCs, the ageing process has a substantial impact. Increased levels of Reactive Oxygen Species (ROS), p21, and p53 are examples of ageing phenotypes expressed by aged BM-MSCs. This trait can make autologous stem cell therapy less effective when employing old cells in an old body. Additionally, the gene expression pattern of the molecular pathways that support and maintain neuroprotection and neuroregeneration following stroke is delayed in the aged brain.

Because of their propensity to develop into neural progenitor cells and their unrestricted availability, Human Umbilical Cord (HUC) cell-derived therapies have gained attention as viable alternatives to traditional stroke treatments in the past 10 years. Hematopoietic Stem Cells (HSCs) and the mononuclear portion of mesenchymal stem cells are both Present in Umbilical Cells (MSCs). The ability of regulatory T-cells (1–5% from HUC cells) to prevent graft vs host illness and to enhance neurogenesis in the ageing brain is a benefit of Umbilical Cord Blood (UCB) derived cells.

Adipose Derived Stem Cells (ASCs) are able to differentiate into a variety of cells that are crucial for the repair of damaged tissue. They can be extracted from adipose tissue with few negative effects. In an animal stroke model, it was discovered that administering IV ASCs increased VEGF levels, which promoted the growth of blood vessels and axonal sprouting while lowering apoptosis and glial scar formation, was safe and improved the outcome of the stroke. However, intravascular distribution of ASCs was more effective than intraventricular injection.

It has been said that gene therapy is an effective method for healing nerve damage. By utilising Endothelial Progenitor Cells (EPCs), Pereira and colleagues demonstrated how the vascular Endothelial Growth Factor (VEGF) gene and Granulocyte Colony-Stimulating Factor (G-CSF) gene stimulate regeneration and enhance functional result.

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CONCLUSION

The effectiveness of stem cell therapies to date has been dismally poor, mostly because it is still unclear how the host neuroinflammatory response the principal barrier to exogenously supplied neural precursor cells interacts with exogenously provided stem cells over time. Only a few researches have shown that stem cells may survive in a strong neuroinflammatory environment, such as an ischemic area in a stroke, despite preclinical studies of neurodegenerative or neuroinflammatory illnesses attributing positive effects to MSC implantation into the brain.